PATENT SPECIFICATION 1,099,472

DRAWINGS ATTACHED.

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COMPLETE SPECIFICATION.

Joints between Timber Structural Members.

We, TIMBER RESEARCH AND DEVELOPMENT ASSOCIATION, a Company registered under the laws of Great Britain, of St. John's Road, Tylers Green, High Wycombe, Buckinghamshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to joints between timber structural members in frames, trusses and other structures, which members carry compressive or tensile loads other than due to their own weight, and one object is to provide such a joint whose tightness can be reliably maintained for indefinitely long periods.

According to the present invention friction between the co-operating faces of the members is used to resist the loads in the member, and the co-operating faces of the members are pressed together by an energy-absorbing self-loading device which maintains load between the members in spite of some variation in their dimensions.

A self-loading device is a device which absorbs energy for maintaining a load, and it could for example consist of a clamp incorporating a compression or other spring and one form of the invention uses a stack of Belleville washers on a bolt holding the members together.

The friction between the co-operating faces of the two members which is used to resist the loads in the structural members composing the joint can be maintained as long as the normal pressure between the surfaces is maintained, and this is ensured by means of the self-loading device.

In the past, timber structural members have been held together merely by bolts and nuts which are tightened to apply the necessary load. However the dimensions of the timber members are not stable largely due to the variation in moisture content and often as timber dries out it shrinks so that all the initial bolt tension may be lost and the frictional force between the co-operating faces will also be lost or greatly reduced. Even well-seasoned timber may have fluctuations in its moisture content due to change in the atmospheric humidity and indeed timber might swell owing to an increase in humidity which might have the effect of increasing the bolt tension sufficiently to cause permanent compressive deformation of the timber which would worsen the effect of subsequent shrinkage.

However, the self-loading device of the present invention enables load to be maintained, possibly reduced, in spite of the reductions in the dimensions of the members. For example, the stack of Belleville washers mentioned above could take up any reduction in dimension and still apply a substantial pressure between the co-operating surfaces.

In order to increase the co-efficient of friction a roughened or other interlayer plate may be included between the co-operating surfaces. This may be a metal plate machine roughened or having grit bonded to it or indeed having integral teeth so as to operate as a double-sided toothed-plate connector.

Moreover the outer faces of the members to be joined have external plates on which the self-loading device acts to distribute the stress over an area and these plates might have their faces against the members similarly roughened.

There may be some freedom of movement between the members provided the frictional force is overcome and this would enable the equivalent of " Plastic Design " to be applied without using the plastic behaviour of the members themselves. Thus the joint can be

[*Price* 4*s.* 6*d.*]

designed to have a certain limiting friction force between the members and if during use a force or movement sufficient to exceed this limiting friction value is applied, the joint will yield in a manner which allows other parts of the structure to carry a greater share of the total load, and after the excessive force has been removed the friction between the members will retain them in the set position of adjustment.

The invention may be carried into practice in various ways and one embodiment will now be described by way of example with reference to the accompanying drawings in which:

Figure 1A is a perspective view of a joint according to the present invention employing external Belleville washers,

Figure 1B is a schematic section of the joint of Figure 1.

Figure 2A is a view similar to Figure 1A of a joint using internal Belleville washers.

Figure 2B is a view similar to Figure 1B of the joint of Figure 2A.

Figure 3 shows a lapped joint using a roughened interplate.

Figure 4 shows a double butt joint.

Figure 5 shows a single butt joint; and

Figure 6 shows frame members joined in accordance with the invention.

In Figure 1 two timber members 1 and 2 are held with their side faces in frictional contact by means of a bolt 3 having nuts 4 at either end acting on the outer sides of the timber members through pressure plates 5 and stacks of Belleville washers 6. The nuts are tightened to compress the washers 6 until a predetermined pressure is imparted to hold the members 1 and 2 together. Subsequent shrinkage of the members will be taken up by expansion of the washer stacks to maintain the members pressed together.

A certain minimum clamping force might be maintained in spite of say 2% reduction in total thickness of the members by arranging for the compressing force before reduction to be suitably in excess of the minimum.

Indeed it is also possible to employ self-loading devices maintaining approximately constant load over the required range of movement. The clamping load may be initially applied by means of a torque limiting device, or the initial deflection may be measured in order to ensure that the correct initial load is applied.

The arrangement of Figure 2 is similar, and similar reference numerals are used, but the appearance is improved by mounting the washers internally and also the joint has improved fire resistance.

The washers 6 are used in pockets 7 extending inwardly from the pressure plates 5 and circular nuts 4*a* are used to put the washers in compression.

Figure 3 shows how the two timber members 1 and 2 held together by the spring-loaded bolts 3 can have the co-efficient of friction increased by means of an interlayer plate 8, possibly a metal plate with grit bonded to its surfaces, which lies between the co-operating faces of the members 1 and 2. The pressure plates 5 will usually have smooth faces but they might in fact be roughened on the sides against the member 1 or 2.

Figure 4 shows a modification also using the spring loaded bolts 3 in which a pair of members 2*a* and 2*b* butt against a single member 1 which is slotted at 9 to receive the internal friction plate 8 which also extends between the members 2*a* and 2*b*. This arrangement gives four interfaces at which friction can be generated. However, the friction between the outer plates 5 and the outer timber surfaces might be weakened by fire if the plates would not take bending moment in their plane although they would continue to distribute the bolt load over the area of the internal plate 8. Thus a joint of this kind would often be calculated assuming friction at the co-operating surfaces with the interplate 9 only.

Figure 5 shows a simple butt joint using spring-loaded bolts 3, and with two pressure plates but if necessary an interplate could be used in a slot equivalent to the slot 9 in Figure 4 of the two members 1 and 2. It is clear that with any of these joints further structural members could be included at the joint.

Figure 6 shows a joint in a rigid frame construction between members 1 and 2 in which moment resistance is required between the members. These joints could be designed to have a certain maximum friction force at a preset load and during overload in use there would be some movement between the members, resulting in a more favourable distribution of bending action in the various parts of the structure; further movement would be prevented by the friction force once the excessive moment had been removed. Such a joint could avoid the need for cross bracing. The bolts are similar spring-loaded bolts.

Use of the clamping method described will increase joint efficiency, allowing simpler joint details and smaller sections of the members. Also the structural deflection caused by joint slip will be reduced so that cambering and bracing can be reduced or eliminated. In general it is believed that by use of these joints the designs of frames and trusses could be simplified.

WHAT WE CLAIM IS:—

1. A joint between timber structural members which carry compressive or tensile loads other than due to thier own weight, in which friction between the co-operating faces

of the members is used to resist the loads in the members and in which the co-operating faces of the members are pressed together by an energy absorbing self-loading device which maintains load between the members in spite of some variation in their dimensions.

2. A joint as claimed in Claim 1 in which the self-loading device consists of a clamp incorporating a compression or other spring.

3. A joint as claimed in Claim 2 in which the spring comprises a stack of Belleville washers on a bolt holding the members together.

4. A joint as claimed in any of the preceding claims including a roughened or other interlayer plate included between the co-operating surfaces.

5. A joint as claimed in Claim 4 in which the plate is a metal plate machine roughened or having grit bonded to it or having integral teeth.

6. A joint as claimed in any of the preceding claims in which the outer faces of the members to be joined have external plates on which the self-loading device acts to distribute the stress over an area.

7. A joint as claimed in Claim 6 in which the external plates have their inner faces roughened.

8. A joint as claimed in any of the preceding claims in which there is some freedom of movement between the members of the joint provided frictional force between them is overcome.

9. A joint between structural members arranged substantially as herein specifically described with reference to Figure 1A and B, Figure 2A and B, Figure 3, Figure 4 or Figure 5 of the accompanying drawings.

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Chartered Patent Agents,
Agents for the Applicants.

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1099472 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

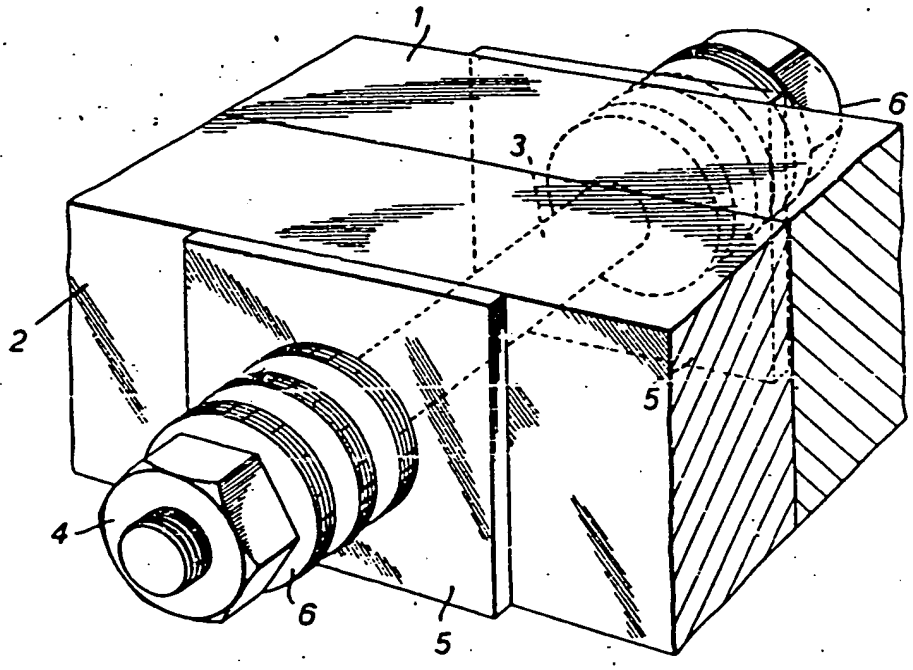


FIG. 1A.

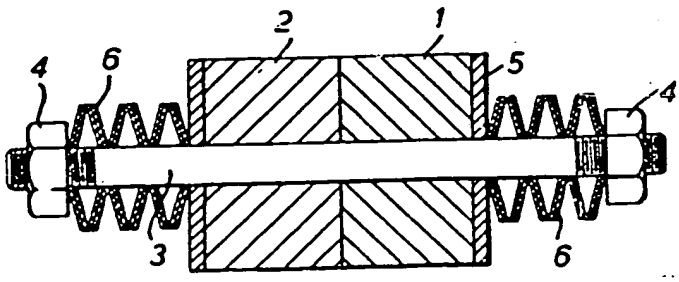


FIG. 1B.

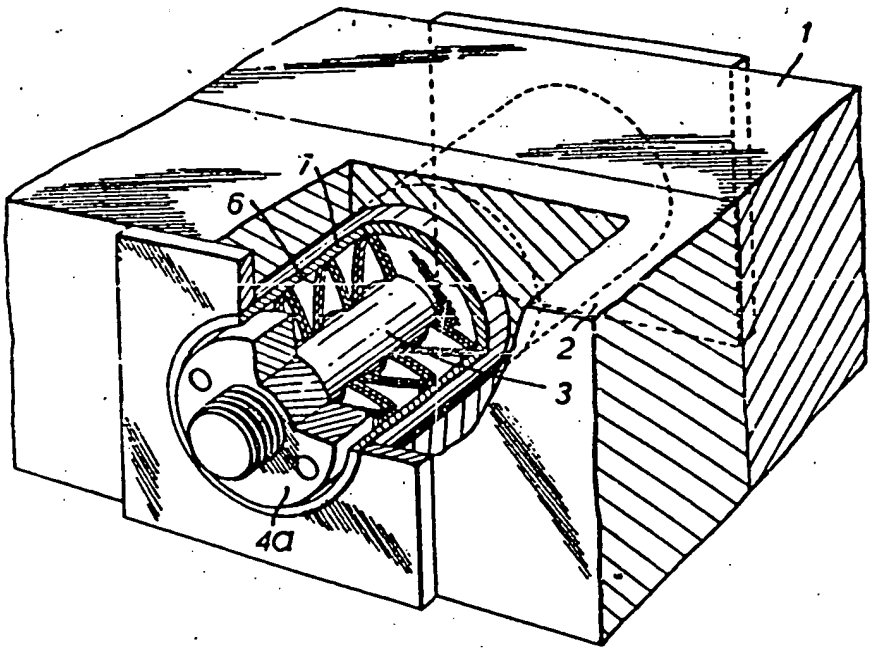


FIG. 2A.

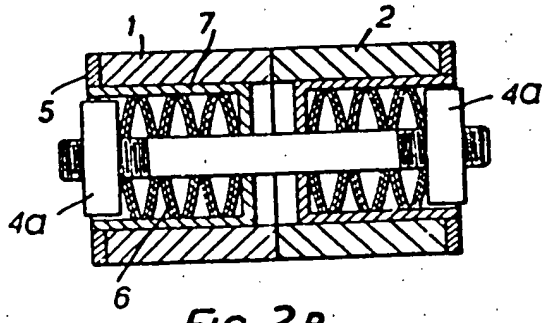
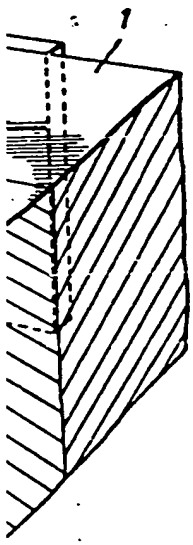


FIG. 2B.

1099472 COMPLETE SPECIFICATION
3 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheets 2 & 3



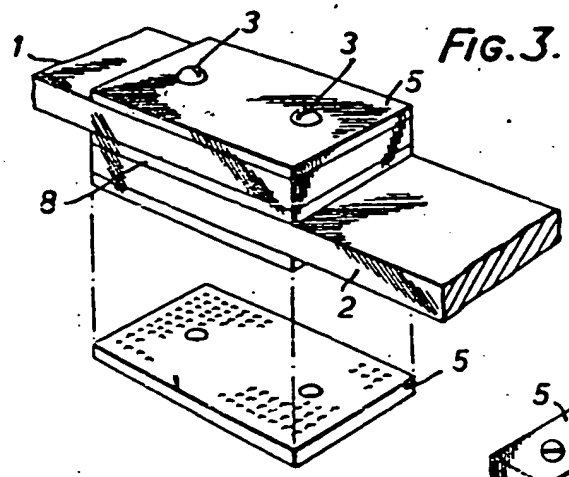
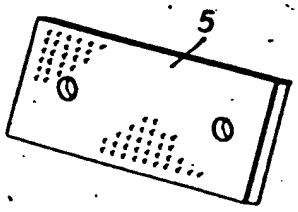


FIG. 3.



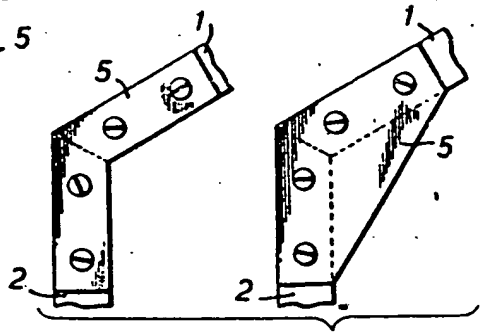


FIG. 6.

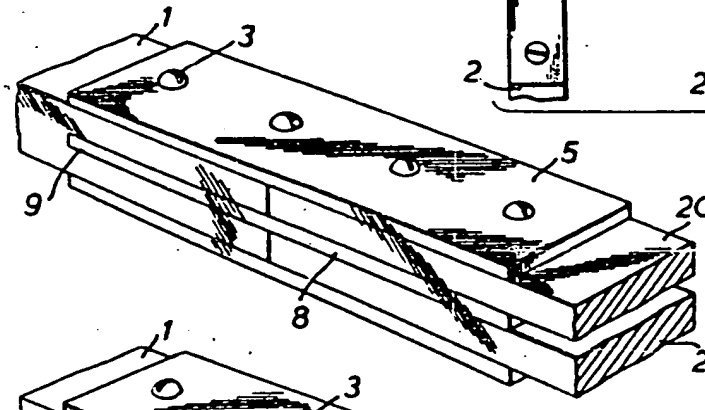


FIG. 4.

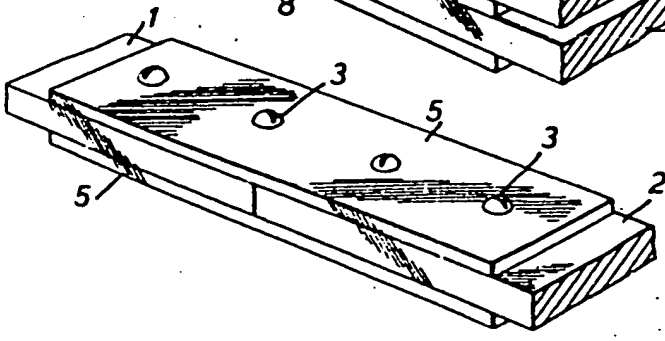


FIG. 5.